A HUMAN BLOOD-GROUP CHIMERA

BY

I. DUNSFORD

C. C. BOWLEY, M.B., B.S., M.R.C.O.G.

ANN M. HUTCHISON, B.Sc.

National Blood Transfusion Service, Regional Transfusion Laboratory, Northfield Road, Sheffield, 10

JOAN S. THOMPSON, B.Sc.

RUTH SANGER, Ph.D.

AND

R. R. RACE, Ph.D., M.R.C.S., F.R.S.

Medical Research Council, Blood Group Research Unit, the Lister Institute, Chelsea Bridge Road, London, S.W.1

Mrs. McK., a donor aged 25, gave her first pint of blood in March of this year. When the blood came to be grouped it seemed to be a mixture of A and O cells, for anti-A serum caused large agglutinates to appear to the naked eye, but the microscope showed these agglutinates to be set in a background of unagglutinated cells. The appearance was such as might be seen for a time after a large transfusion of O blood into an A recipient : but Mrs. McK. had never been transfused. Further samples excluded the possibility of any accidental mixing of bloods.

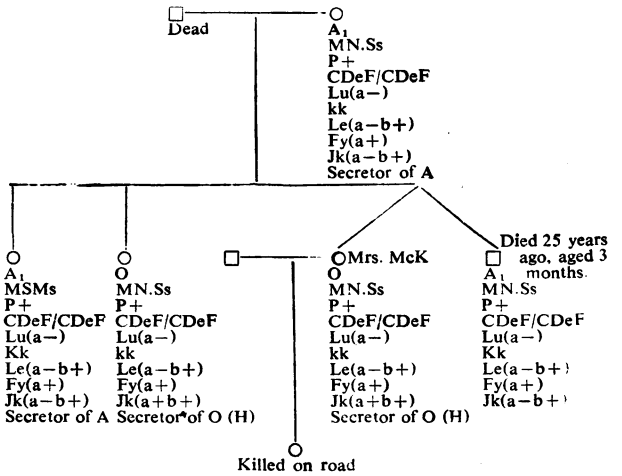
The evident mixture of blood called to mind the work of Owen (1945) on "immunogenetic consequences of vascular anastomoses between bovine twins." Anastomoses are usually present between bovine twin embryos ; primordial red cells belonging to one twin take root in the other twin and continue throughout the life of that animal, to produce red cells with genetically foreign antigens. Chorionic vascular anastomosis and transfer of endocrine secretions between bovine twins of different sex had been postulated as the cause of the freemartin condition by Lillie as early as 1916.

When asked if she were a twin, Mrs. McK., somewhat surprised, answered that her twin brother had died 25 years ago at the age of 3 months. The cause of death was said to be pneumonia complicating a strangulated inguinal hernia.

The O and A_1 cells in the blood of Mrs. McK. can be separated. The result of grouping the two components is shown in the pedigree ; the O cells are kk, Jk (a+b+), the A_1 cells are Kk, Jk (a−b+) : in their other groups they do not differ. There is no doubt that the true genetic blood groups of Mrs. McK. are those shown under her name in the pedigree. This is established by the fact that she secretes O (H) antigen in her saliva but does not secrete A antigen. Since the red cells of her twin are A_1, Le(a−b+) he must have secreted A. It is strange that we should be able to group completely this twin 25 years after his death.

Miss Marie Cutbush, of the Medical Research Council Blood Transfusion Research Unit, has counted the relative numbers of the two kinds of red cells : 61% are Group O ($\sigma = 1.7\%$), which does not differ significantly from the count made by Miss Cutbush one month earlier.

Mrs. McK. is the first human being to be shown to have a double set of blood groups, and there can be little doubt that one set is the consequence of vascular communication with her twin. Though we have been prepared for this discovery by the work of Owen on bovine twins, such a mixture of blood cannot be common in human twins : the Blood Group Research Unit has tested the blood of 58 pairs of dissimilar twins and 82 pairs of apparently identical twins without finding any evidence of mixed blood groups. Alternative explanations have been considered : somatic mutation is excluded because three separate genes are involved, and dispermia is highly improbable, for Mrs. McK. shows no obvious sign of asymmetry. None of the blood samples from the other surviving members of the family was in any way unusual.



The blood groups of Mrs. McK. and of her family. The groups shown under Mrs. McK. are those which she inherited and about 61% of her red cells are stamped with these groups. About 39% of her red cells are of the groups shown under her twin brother. The antisera used to group the family and the two components of Mrs. McK.'s blood were: anti-A-A_1-B-"O"-H, anti-M-N-S-s, anti-P, anti-C-c-Cw-D-E-e-f, anti-Lu^a, anti-K-k, anti-Le^a-Le^b, anti-Fy^a, anti-Jk^a-Jk^b.

Apart from its general interest the case of Mrs. McK. has particular implications :

(*a*) The early presence of A antigen has presumably inhibited the production of anti-A. Mrs. McK. is group O and her serum contains anti-B, but there is no detectable anti-A : it has been looked for by methods using saline, albumin, anti-human globulin, trypsin, and papain. If anti-A were being produced by Mrs. McK. and promptly adsorbed, the only tissue capable of such adsorption would be her A_1 cells, but these cannot be shown to be either sensitized or blocked.

(*b*) Secretion of A antigen in saliva clearly must depend on the presence in the genotype of the A gene as well as the secretor gene, for the secretor gene of Mrs. McK. cannot command the secretion of A present only in her circulation.

(*c*) Mrs. McK. is feminine in appearance and has had one child : she is clearly not a freemartin. Nevertheless, now that it is established that there can be prenatal communication between the circulations of dissimilar human twins, it may be worth recording the proportion of twins among people suffering from infertility and from abnormal sexual development.

In 1916 Lillie wrote : "In the case of the free-martin, nature has performed an experiment of surpassing interest." No doubt the same could be said of Nature's experiment on Mrs. McK. were we able to appreciate more of its implications.

REFERENCES

Lillie, F. R. (1916). *Science*, **43**, 611.
Owen, R. D. (1945). Ibid., **102**, 400.

The World Health Organization Area Representatives' Conference held recently in Delhi approved a proposal that W.H.O. should assist the Ceylon Government to initiate a postgraduate course for nurses in administration and training at the Colombo Nurses Training School : at present, nurses from Ceylon are sent abroad for postgraduate training. The Area Representatives Conference also agreed to the provision of a principal and three nursing tutors for a nurses' training school to be established at Galle or Jaffna in Ceylon. W.H.O. will also give Ceylon help in controlling tuberculosis, venereal diseases, and leprosy.